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Electophysiological assessments of the effects of Glycemic events, Ascorbic acid and Thaimine, on the Peripheral Neuropathy of Diabetes Mellitus Patients

دراسة كهرو–فسيولوجية لتأثير فيتامين سي وفيتامين ب١ ومستوى سكر الدم على الأعصاب الطرفية لمرضى السكري

I.W.M. Al- Hasan*, and G.A. Al- Sharify**

**Faculty of Pharmacy, An-Najah National University, Nablus, Palestine.*

***Al-Yarmouk Hospital, Baghdad.*

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Abstract

Three groups of patients who had diabetes mellitus for 10 years were enrolled in the study and compared with the control group.

Electrophysiological study on seven peripheral nerves were carried out once in the control subjects and four times in the diabetic patients; the first examination was conducted prior to drug supplement and the subsequent reexaminations conducted at the end of 6; 12 and 18 months following the drugs treatments, ascorbic acid (AA) and Thiamine (B1).

The results indicate that improvements in latency, velocity and amplitude of the nerves evoked responses were significantly better with the use of AA compared to thiamine use in the patients.

The results also show that the improvements were significantly greater in insulin dependent diabetes mellitus (IDDM) compared to that of non insulin dependent diabetes mellitus (NIDDM) patients with the presence of AA in both groups.Nevertheless the results indicate that with better glycemic control, the tested nerves show variable degrees of functional improvements detected by the three examined parameters at the end of the 6 and 12 months. At the end of the last visit (18 months after the first visit) more improvements were observed in the three parameters of IDDM patients.

Key words: Ascorbic acid , Thiamine, Insulin, effectiveness, Diabetic Neuropathy.

ملخص

اشتملت هذه الدراسة على ثلاث مجموعات من الأشخاص المصابين بمرض السكري منذ عشر سنوات تقريبا وكان عدد كل مجموعة ٢٥ مريضاً وقد وافقوا على إجراء الفحوصات والتجارب وتم مقارنة النتائج مع مجموعة رابعة من الأشخاص الأصحاء.

لقد أجريت التجارب بهدف معرفة تأثير فيتامين سي وفيتامين ب١ بالإضافة الى مدى تأثير خفض سكر الدم بواسطة الانسولين على سبعة من الأعصاب الطرفية العليا والسفلى، وتم متابعة التغيرات في تحسن الأداء الوظيفي للأعصاب لمدة ١٨ شهراً باستعمال التكنيك الكهرو-فسيولوجي لقياس سرعة نقل الايعازات العصبية وقياس فترة الكمون الحسي والحركي بالإضافة الى المدى الكامل للاستجابة العصبية في نهايات الأشهر السادس والثاني عشر والثامن عشر.إن نتائج الدراسة تشير بوضوح الى تحسن الأداء الوظيفي للأعصاب نتيجة للعلاج باستعمال فيتامين سي وفيتامين ب١ ولكن التحسن الأعلى كان باستعمال فيتامين سي، كذلك أظهرت النتائج أن الأداء الوظيفي للأعصاب كان هو الأحسن لمرضى السكري المعتمد على الأنسولين منه في المرضى غير المعتمدين على الانسولين وأن التحسن في الأداء الوظيفي للأعصاب كان أكبر في نهاية الشهر الثامن عشر منه في نهاية الشهر السادس أو الشهر الثاني عشر أي ان التحسن كان تدريجيا.

Introduction

Because of the diversity in the causative and contributing factors in the pathogenesis of diabetic neuropathies, it seems no satisfactory single treatment for this disease has been forhtcoming [1] and the precise pathogensis of the diabetic peripheral neuropathy remains largely unknown [2].

It was found that AA is necessary for the thin oxidation- reduction mechanism of body tissue including the nerve cells [3]. The action of AA is important in maintaining the cellular normal functions [4]. It has been reported that the levels of AA in the plasma and various tissues are decreased in diabetic patients[5]. Furthermore it has been suggested that AA supplementation may help to prevent the development of some diatbetic complications [6-7]. It was also reported that reduced nerve conduction velocity in diabetic rats being correctable by AA supplementation [8] and the superiority of AA over some pharmaceutics have reported [9]. In an experimental work on sorbutic animals, it was

also found that AA is involved in the carbohydrate metabolism [3]. The cellular uptak of AA is an energy dependent carrier mediated process [10]. Glucose share a common transport system with AA and dehydroascorbic acid [11]. Hyperglycemia may reflects an intracellular deficit of AA through the competitive inhibition of membrane transport of AA by the chronically elevated plasma glucose [12].

It is reported that the minimal thiamine requirement in human is approximately 0.33 mg/ 1000 Kcal [13]. Thiamine deficiency causes a distal sensory motor neuropathy, particularly in the lower extremities and if the deficiency is prolonged the small nerve fibers degenerate as well [14]. Thiamine deficiency was found in diabetic patients who had reduced patellar tendon reflex [15]. Sensorineural deafness was also reported in the diabetic patients of thiamine dependent megaloblastic anemia [16]. Thiamine carries its function in the body in the form of coenzyme thiamine pyrophosphate [17]. In the carbohydrate metabolism, thiamine acts as a coenzyme in the decarboxylation of pyruvic acid and α- ketoglutaric acid and the utilization of pentose in hexose monophosphate shunt. In thiamine deficiency, the oxidation of α - keto acid is impaired which leads to an increase in the level of pyruvic acid in the blood. Thus thiamine requirment is related to metabolic rate and type of diet [18]. Thiamine is considered to have better metabolic effect in insulin dependent diabetic patients and leads to a decrease in the required insulin dose [19].

The role of normalizing blood glucose concentration, for the control of diabetic complications, cells can not survive if they are not fully elucidated. It was found that cultured neuronal cells can not survive if they are exposed to high glucose concentration [20]. However there is increasing evidence that the probability of developing microvascular are reduced by good glycemic control. This might be difficult to prove because of the lack of good animal models, the difficulty in normalizing blood sugar in diabetic patients all the time and the lack of defined end point [21-23].

Aims of the study

Byas- Smith and his colleagues, in 1995, reported that the precise pathogenesis of diabetic peripheral neuropathy is still unknown.

The present study aimed to evaluate the effectiveness of ascorbic acid, thiamine and glycemic events on the electrophysiological properties of seven peripheral nerves of the diabetic patients.

Methods

A. Patients and drug treatment

For evaluating the effectiveness of treatment modality on the course of peripheral neuropathy, diabetic patients who were attending Al-Yarmouk Teaching Hospital were divided into three groups as shown in Table 1. They agreed to conduct the examination for them and showed good cooperation during 18 months of following up.

Ascorbic acid [AA] was given to each patient of groups 1 and 3 in a dose of 500 mg/ day and thiamine was given to each patient in group 2 in a dose of 50 mg /day.

Patients of renal or liver dysfunction were excluded from the study.

Table 1: The group of patients enrolled in the study according to the type of DM and treatment modality.

Group number	Type of DM	The used drug	Duration of DM	Number of patients
1	IDDM	Ascorbic acid	10 ± 1.30 years	25
2	IDDM	Thiamine	10± 1.10 years	25
3	NIDDM	Ascorbic acid	10± 1.13 years	25

B. Electrophysiological measurments

The electrophysiological examination of the tested nerves were carried out one time only for the control subjects and for the patients who have

given the treatment were tested four times, including the first visit and the subsequent reexamination at the end of 6,12,18 months. On each visit the ulnar and median nerves of the upper limb and sural, common peroneal and posterior tibial nerves of the lower limb were tested for latency, conduction velocity and amplitude of the evoked response .

The skin was carefully prepared at both the stimulating and recording sites. It was disinfected by 70% alcohol and gently rubbed to decrease its resistance to the applied current.Maximum response was usually obtained by a current ranged 40-60 and 15-25 mamp when testing motor and sensory fibers respectively. All recordings were carried out on limbs of the right side of the patients. During examination of the median and ulnar nerves, the subject lies supine with the arms extended 180° at the elbow. The knee bent 120° when the peroneal and posterior tibial nerves were examined. When sural nerve was examined the subject lies prone with a support under the ankle with the knee at an angle of a 140° [24].

All the recordings were performed in an air conditioned room with a temperature of $23\pm2C^{\circ}$ and the skin temperature of the examined subjects were $34 \pm 1.5C^{\circ}$ and $35 \pm 1.4\ C^{\circ}$ for the lower limbs and the upper limbs respectively.

The Neuromatic 2000C apparatus was used in the present study. It is a fully equipped of two channel neuromyograph for clinical EMG nerve conduction study and [NCS] evoked response recordings. It is a microcomputer controlled instrument, comprising an active electode box with patient – isolated inputs, EMG- amplifier,averages monitor loudspeaker, chart recorder, stimulator for NCS and somatosensory evoked repponded. The monitor has a wide range of sweep setting and digital display of latency and duration.

The evoked reponses from the nerves and muscles which picked by the electrode tips were fed to the EMG amplifier that provided by calibration facilities .

1. Motor nerve conduction recording [MNCR]

The motor latency was measured to the nearest 0.1 msec from the onset of the stimulus artifact to the initial deflection from the baseline of the muscle action potential. The conduction time between the two stimulating points and the difference between the proximal and distal latencies were recorded directly on the screen. The distance between the center of the stimulating cathodes as measured on the skin following the course of the nerve was taken to be the nerve conduction distance. The motor conduction velocity [MCV] was calculated by dividing the conduction distance [in meters] by the conduction time [in seconds].

2. Sensory nerve conduction recordings [SNCR]

The sensory latency was measured from the onset of the stimulus artifact to the initial postive peak of the sensory action potential [SAP]. The nerve conduction distance was measured on the skin between the center of the stimulating cathode and the center of sensory conduction velocity [SCV] which was calculated directely by dividing the nerve conduction distance [in meters] by the latency [in seconds]. The amplitude of the nerve action potential was measured from peak to peak [positive to negative deflection from the baseline].

Statistics

Statistical analysis of the obtained recordings were carried out by feeding the data into IBM computer. The arithmetic mean, standard deviation (SD) and correlation coefficient (γ) were calculated by using statistics methods [25]. Students paired and unpaired t- test were used to analyze the differences between the nearst subgroups concerning the P- values; any value higher than 0.05 was considered to be statistically insigificant and the levels of statistical significancy are illustrated in the tables.

Results

1. The tested parameters are mentioned in the same order i.e. latency, conduction velocity and amplitude without their units.

2. The units of these parameters are milliseconed, meter per second and millvolt respectively.
3. Values are expressed in mean ± SD in the tables but in the text values are expressed by their means only.
4. The data of the tested parameters in the first visit of patients were compared to that of the control group recordings.
5. The data of the 6,12 and 18 months visits are compared to that of the first visit

I. IDDM Patients Table 2

Effect of Ascorbic Acid

The Examination of the three parameters in the first visit of the patients were measured and compared to the control group records, Significant recording changes in the seven examined nerves were observed.

In general the reexamination of the nerves after 6 and 12 months gave insignificant changes of the obtained records when compared to the first visit recordings of the patients.

Reexamination of the seven nerves after 18 months gave singnificant recording changes for the three parameters only in two nerves namely the median and ulnar motors. Also significant recording changes were obtained for the conductive velocity of the sural, common peroneal and posterior tibial nerves when compared to the first visit recordings.

II. IDDM Patients Table 3

Effects of thiamine

The first visit recordings for the patients of latency, conductive velocity and amplitude of the seven nerves when compared to the control group recordings gave significant changes almost in the three parameters of the examined nerves.

	Nerve	Control				1st visit				6 Months				12 Months				18 Months			
	Nerve	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs
1	Sural Nerve	2.93 ± 0.42	43.65 ± 5.4	6.57 ±2.4	91.16 ±15.5	4.85 ± 1.[illegible]5	38.76 ± 4.64	5.6 ± 1.69	180 ± 28	4.36 ± 1.1	39.2 ± 4.22	6.2 ± 1.67	167 ± 16.2	4.2 ± 1.1	40.9 ± 3.5	6.29 ± 1.61	132 ± 19	3.5 ± 0.78	42.0 ± 4.4	6.5 ± 1.31	104 ± 1818
2	Common Peroneal	3.59 ± 0.46	46.02 ± 4.2	5.11 ± 1.8		* 5.23 ± 1.[illegible]	* 37.6 ± 5.51	N 3.33 ± 1.39	**	N 5.15 ± 1.19	N 37.9 ± 5.1	N 3.42 ± 139	N	N 5.02 ± 0.08	N 39.1 ± 4.2	N 3.63 ± 1.21	*	N 4.02 ± 0.85	* 42.7 ± 4.4	N 4.37 ± 0.88	**
						*	*	*		N	N	N		N	N	N		N	*	*	
3	Posterior Tibial	3.63 ± 0.6	44.12 ± 5.2	4.73 ± 1.85		4.53 ± 1.0[illegible]	38.5 ± 4.45	3.7± 1.63		3.98 ± 0.93	38.99 ± 3.9	4.3± 1.5		3.89± 0.85	39.7± 3.6	4.5± 147		3.19± 0.73	43.1± 3.79	4.67± 1.12	
						*	*	N		N	N	N		N	N	N		*	*	N	
4	Median Sensory	2.74± 0.4	47.7 ± 4.7	8.01 ±2.3		3.66 ± 0.36	42.12 ± 5.34	4.6± 1.71		3.01 ±0.4	43.2± 5.2	4.69 ±1.6		3.0 ± 0.78	43.2± 6.7	4.7 1 ±1.6		2.7± 0.66	45.1± 5.56	5.4± 0.8	
						N	N	**		N	N	N		N	N	N		N	N	N	
5	Median Motor	3.18 ± 0.4	50.2 ± 5.0	5.7± 2.0		4.5± 0.89	41.4 ± 7.51	4.4± 1.04		4.27 ± 0.87	42.9± 6.9	4.45 ± 1.03		4.0± 0.78	43.9± 6.7	4.81 ± 1.05		3.2± 0.66	45.1± 5.56	5.44± 0.8	
						*	*	*		N	N	N		N	N	*		*	*	*	
6	Ulnar Sensory	2.34± 0.4	4.69 ± 6.0	7.9± 2.2		3.0± 0.61	45± 4.62	5.02± 1.64		2.5± 0.6	46.4± 4.6	5.38 ±1.6		2.46± 0.54	46.7± 4.5	5.49± 4.6		2.19± 0.21	47.9± 3.95	5.88± 1.4	
						N	N	*		N	N	N		N	N	N		N	N	N	
7	Ulnar Motor	2.58± 0.52	50.7 ± 5.7	6.2± 1.8		3.7± 0.6[illegible]	46 ± 4.21	5.06± 1.62		2.82 ± 0.04	47.6± 4.34	5.28 ±1.6		2.75± 0.53	49.01 ± 4.06	5.4± 1.6		2.5± 0.46	50.5± 3.85	5.87± 1.6	
						*	*	*		N	N	N		N	*	N		*	*	*	

Table 2:- Nerve Conduction Study [NCS] of IDDM patients with – 10y duration , on AA
N= Not significant *P < 0.05
** P < 0.005 *** P < 0.0005

	Nerve	Control				1st visit				6 Months				12 Months				18 Months			
	Nerve	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs
1	Sural Nerve	2.93 ± 0.42	43.65 ± 5.4	6.57 ±2.4	91.16 ±15.5	4.74 ± 1.11	38.9 ± 6.72	5.0 ± 1.87	206 ± 49.2	4.47 ±0.9	39.2± 4.4	5.01 ± 1.74	179± 47	4.27± 0.69	40.8± 4.2	5.4± 1.6	157 ±31	3.5± 0.56	42.4± 3.4	5.72 ± 1.5	138± 21
						*	*	*	**	N	N	N	*	*	*	N	*	**	*	*	***
2	Common Peroneal	3.59± 0.46	46.02 ± 4.2	5.11 ±1.8		4.49 ± 0.64	41.8 ± 4.38	4.06± 1.42		4.0± 0.55	42± 3.2	4.06 ± 1.3		3.99± 0.65	42.2± 3.3	4.09± 1.3		3.90± 0.5	43.9± 1.5	4.7± 1.2	
						*	N	N		N	N	N		N	N	N		*	N	N	
3	Posterior Tibial	3.63± 0.6	44.12 ± 5.2	4.73 ± 1.85		4.75 ± 1.15	39.4 ± 7.8	3.47± 1.58		4.69 ± 1.07	40.44 ± 7.4	3.5± 1.8		4.5± 0.97	40.5± 6.9	3.6± 01.6		4.0± 0.7	42.5± 5.3	4.08± 1.4	
						*	*	*		N	N	N		N	N	N		N	N	N	
4	Median Sensory	2.74± 0.4	47.7 ± 4.7	8.01 ±2.3		3.99 ± 0.69	37.8 ± 6.4	5.22± 1.91		3.32 ± 0.69	38.38 ±5.8	5.29 ±1.8		3.02± 0.55	40.1± 4.5	5.48± 1.6		3.0± 0.4	41.1± 3.36	5.94± 1.5	
						*	*	*		N	N	N		*	*	*		*	**	*	
5	Median Motor	3.18± 0.4	50.2 ± 0.4	5.7± 2.0		3.98 ± 0.97	40.46 ±8.9	4.73± 1.79		3.75 ± 0.96	41.9± 6.3	4.8± 1.64		3.6± 0.86	41.2± 5.5	4.97± 1.6		3.3± 0.6	42.6± 5	5.34± 1.6	
						N	*	*		N	N	N		N	N	N		N	N	N	
6	Ulnar Sensory	2.34± 0.4	4.79 ± 6.0	7.9± 2.2		2.88 ± 0.69	41.28 ± 5.2	5.41± 1.79		2.85 ± 0.55	41.9± 4.9	5.72 ± 1.46		2.4± 0.5	43.8± 4.07	5.9± 1.3		2.06± 0.39	44.3± 3.2	6.25± 1.3	
						N	*	*		N	N	N		*	*	N		*	*	N	
7	Ulnar Motor	2.58± 0.52	50.71 ± 5.7	6.2± 1.8		2.93 ± 0.44	45.4 ± 7.55	5.48± 1.85		2.87 ± 0.42	45.7± 6.5	5.49 ± 1.85		2.82± 0.35	46 ± 5.02	5.7± 1.7		2.3± 0.28	46.7± 5.4	6.07± 1.7	
						N	*	*		N	N	N		N	N	N		N	N	N	

Table 3: Nerve Conduction Study [NCS] of IDDM Patients with – 10y duration , on B1

N= Not significant * P < 0.05

** P < 0.005 *** P < 0.0005

	Nerve	Control				1st visit				6 Months				12 Months				18 Months			
	Nerve	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs	Lat	Vel	Amp	Fbs
1	Sural Nerve	2.93 ± 0.42	43.65 ± 5.4	6.57 ± 2.4	91.16 ± 15.5	5.17± 0.78	38.03 ± 6.48	3.98 ± 1.4	215.6 ± 4.7	5.0± 0.68	39.0± 5.0	3.99± 1.0	1.96 ±41.5	4.08 ±0.6	40 ± 4.1	4.0 ± 0.93	168 ± 38	3.99± 0.4	41.1± 2.9	4.75± 0.7	133 ±26
						**	*	**	***	N	N	N	*	N	N	N	*	N	*	N	**
2	Common Peroneal	3.59 ± 0.46	46.02 ± 4.2	5.11 ± 1.8		4.9 ± 0.72	40.10 ± 5.25	2.81 ± 1.4		4.5± 0.51	41.54 ± 2.9	3.0± 1.19		4.36 ±0.5 1	42.2 ± 2.58	3.2± 1.17		3.7± 0.4	43.9± 2.4	3.8± 0.9	
						*	*	**		N	N	N		N	*	*		*	*	*	
3	Posterior Tibial	3.63± 0.6	44.12± 5.2	4.73± 1.85		5.24 ± 0.8	39.8 ± 4.37	2.98 ± 1.12		4.94± 0.51	41.33 ± 3.28	3.06± 1.0		4.0± 0.48	41.46 ± 3.09	3.02± 0.9		4.0± 0.43	44.0± 2.2	3.88± 0.8	
						*	*	**		N	N	N		N	N	N		*	*	*	
4	Median Sensory	2.74 ± 0.4	47.7 ± 4.7	8.01 ± 2.3		3.99 ± 0.63	39.06 ± 4.64	3.97 ± 1.7		3.7± 0.53	40.9± 4.03	4.01± 1.39		3.6± 0.48	40.9± 3.7	4.25± 1.24		3.2± 0.4	41.9± 3.0	4.69± 0.9	
						*	**	**		N	N	N		N	N	N		N	N	N	
5	Median Motor	3.18 ± 0.4	50.2 ± 5.0	5.7 ± 2.0		4.55 ± 0.76	43.12 ± 6.04	3.37 ± 1.7		4.05± 0.66	44.04 ± 4.04	3.58± 1.46		3.95 ± 0.58	45± 3.8	3.65± 1.39		3.47± 0.49	46.7± 3.33	4.3± 1.1	
						*	**	*		N	N	N		N	*	N		*	*	*	
6	Ulnar Sensory	2.34 ± 0.4	4.79 ± 6.0	7.9 ± 2.2		3.59 ± 0.94	41.1 ± 3.52	4.3 ± 2.2		3.4± 0.8	43.0± 3.36	4.67± 2.07		3.34 ± 0.72	43.7± 3.5	4.89± 1.95		3.0± 0.6	44.7± 3.0	5.11± 1.95	
						*	*	**		N	N	N		N	N	N		N	*	N	
7	Ulnar Motor	2.58 ± 0.52	50.71 ± 5.7	6.2 ± 1.8		4.32 ± 0.92	42.7 ± 5.54	3.96± 1.7		3.7± 0.71	44.0± 4.8	4.19± 1.65		3.61 ± 0.62	44.8± 3.8	4.19± 1.6		3.17± 0.5	45.9± 3.06	4.75± 1.3	
						*	**	**		N	N	N		*	*	N		*	**	*	

Table 4 : Nerves Conduction Study [NCS] of NIDDM Patients with – 10y duration , on AA

N= Not significant * $P < 0.05$

** $P < 0.005$ *** $P < 0.0005$

The obtained recordings of the 6 months examination when compared to the first visit recordings gave insignificant changes in the three parameters of the seven nerves. After 12 and 18 months the reexamination gave significant recording changes in the parameters of three nerves i.e. the sural, median sensory and ulnar sensory.

III. NIDDM Patients Table 4

Effects of ascorbic acid

The obtained records at the first visit of patients for latency, velocity and amplitude of the seven nerves gave significant changes for the three parameters when compared to the control group records.

The recordings that were obtained at the 6 months examination of the seven nerves when compared to the first visit records gave insignificant changes in the three parameters and almost similar results obtained at the 12 months examination.

The reexamination which was conducted at the 18 months for the latency, conductive velocity and amplitude showed significant recording changes in four nerves i.e common peroneal, posterior tibial, median motor and ulnar motor when compared to the first visit recordings.

Discussion

Improvements in nerve function can be used as an indication for comparison between different treatment modalities in diabetic patients [26].

Ascorbic acid was used in the present study to evaluate its effectiveness on nerves function. The obtained results Tables (2) and (3) for latency , velocity and amplitude show significant levels of improvements when using AA in contrast to using thiamine in the corresponding groups of IDDM patients. These results are in good agreement with the findings of [15-16,19] who found that only little effectiveness of thiamine in clincal neuropathy.

The more profound effects of AA over B1 in IDDM patients for the examined three parameters may suggest the advantage of this vitamin in improving the nerves functions namely as the followings.

1. Direct inhibitory effects on polyol pathway [of metabolic hypothesis] by lowering the sorbitol / glucose ratio which is the indicator of polyol activity [27-28]. Increased polyol activity leads to the depletion of NADPH by aldose vasodilator and neuromodulator in the nerves [29], predisposing to vascular changes [ischemic-hypoxic].
2. With better glycemic control, AA entry into the cell is aided by Na^+ gradient dependent mechanism, this glucose- dependent process will further improve the metabloic functions of neurones [12,30] and so AA could promote the transport of glucose into the cells [28].
3. Due to the anti- oxidant effects of AA, it could promote the neuronal function and neuronal blood flow by lowering the free radicals activity, an effect ensured by [8].

The obtained results also indicate that the improvement in nerve function latency, conductive velocity and amplitude was greater in IDDM patients compared to those in NIDDM after the treatment with AA. These findings suggest that in the presence of AA, insulin plays an important role in regulating and stabilizing the cell membrane and neuronal cell function. These findings are in agreement with [23,30] reports who indicated that insulin has a direct effect on nerve cell functions in addition to its glycemic control.

In general, the obtained results showed that, with better glycemic control, the tested nerves gave variable degrees of improvement in the three examined parameters during the 6 or 12 months visits of the patients. More valuable improvement was obtained at the 18 month compared to first visit records. These results are in agreement with [23] that the glycemic control reduces the risk, of clinical neuropathy in diabetics who had the disease for 1-15 years. These results are also in harmony with some other publications in this respect, for example there is an association of increased levels of diabetic neuropathy with poor glycemic control during 10 years of studies [31]. The metabolic control provided

by self regulated source of insulin, does not only halts, but also ameliorates nerve function even if polyneuropathy is advanced [32].

The presnt study indicate that the improvements in latency, velocity and amplitude of sural, common peroneal and median motor nerves were better than the improvements that occurred in the other examined nerves [Table 2]. Thus these three nerves, can be regarded as early markers of nerve function improvements in IDDM patients. These findings are in good agreement with [31,33] that the sural and common peroneal nerves of the upper limb could be useful indicators of diabetic neuropathy.

Conclusion

With good glycemic control, the use of Ascorbic acid in a dose of 500mg/ day for every diabetic patient is necessary as AA has showen to have a positive influence in the reduction of neuropathic complications in the patients.

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